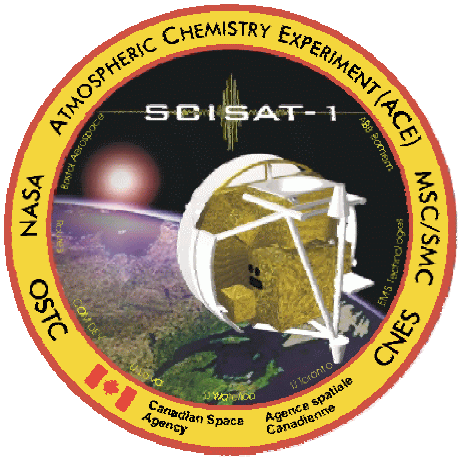

The Atmospheric Chemistry Experiment (ACE): Mission Update

Kaley Walker[1,2], Chris Boone[1], Jay Kar[2], Gaëlle Dufour[3], Daniel Markel[1], Matthew Cooper[1], Ryan Hughes[1], Randall Skelton[1], Sean McLeod[1], Peter Bernath[1,4], Kim Strong[2], Jim Drummond[2,5], and Tom McElroy[2,6]

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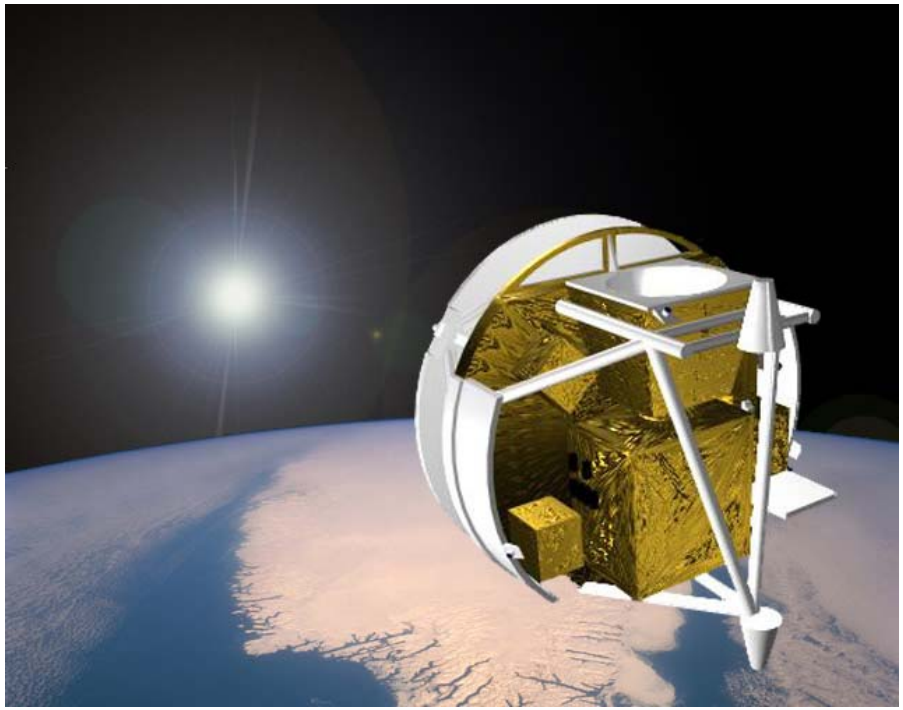
[4]University of York (UK), [5]Dalhousie University, [6]Environment Canada

Aura Science Team Meeting - 14 September 2006

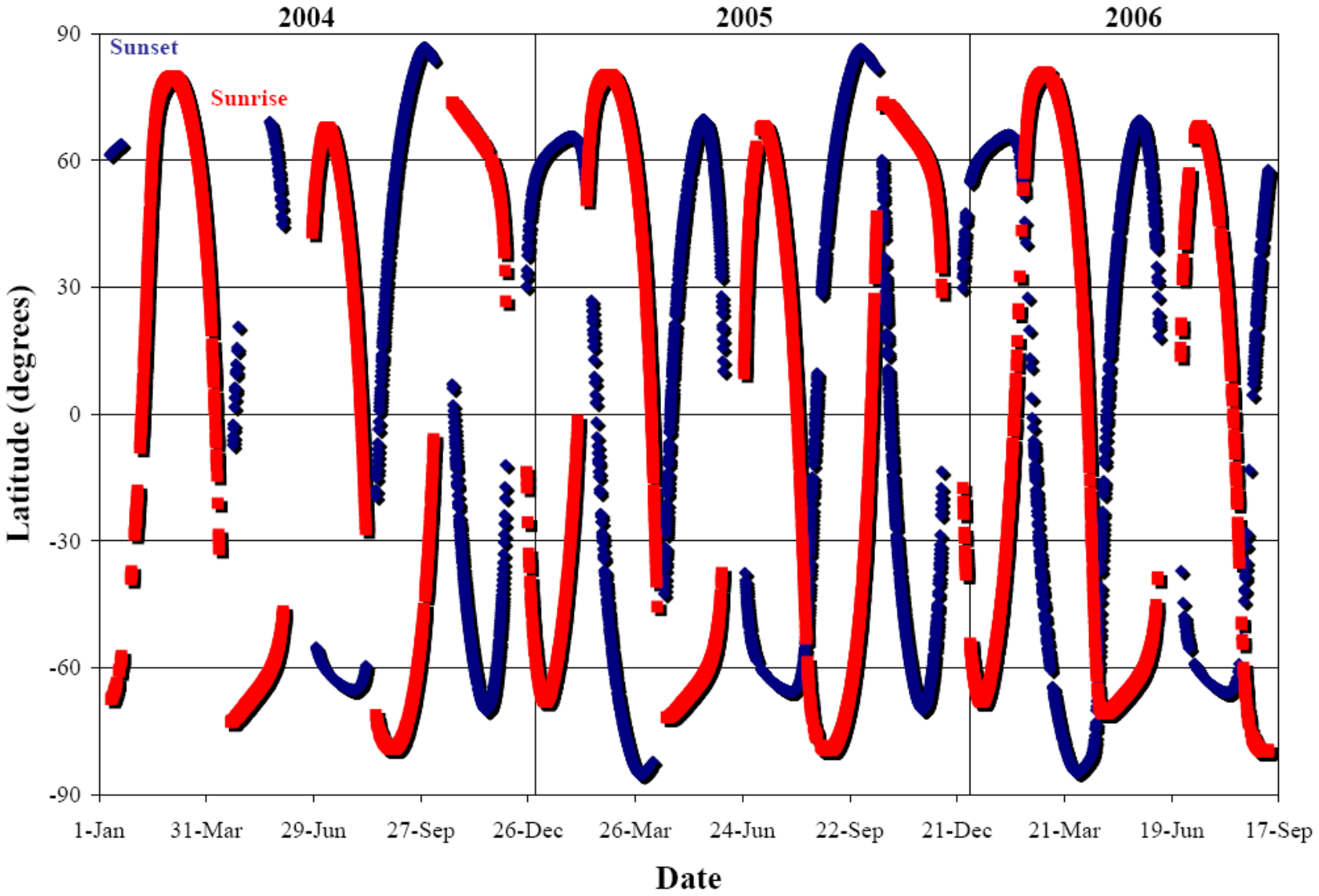
SCISAT-1

Goal: to investigate chemical and dynamical processes that control the distribution of ozone in stratosphere and upper troposphere



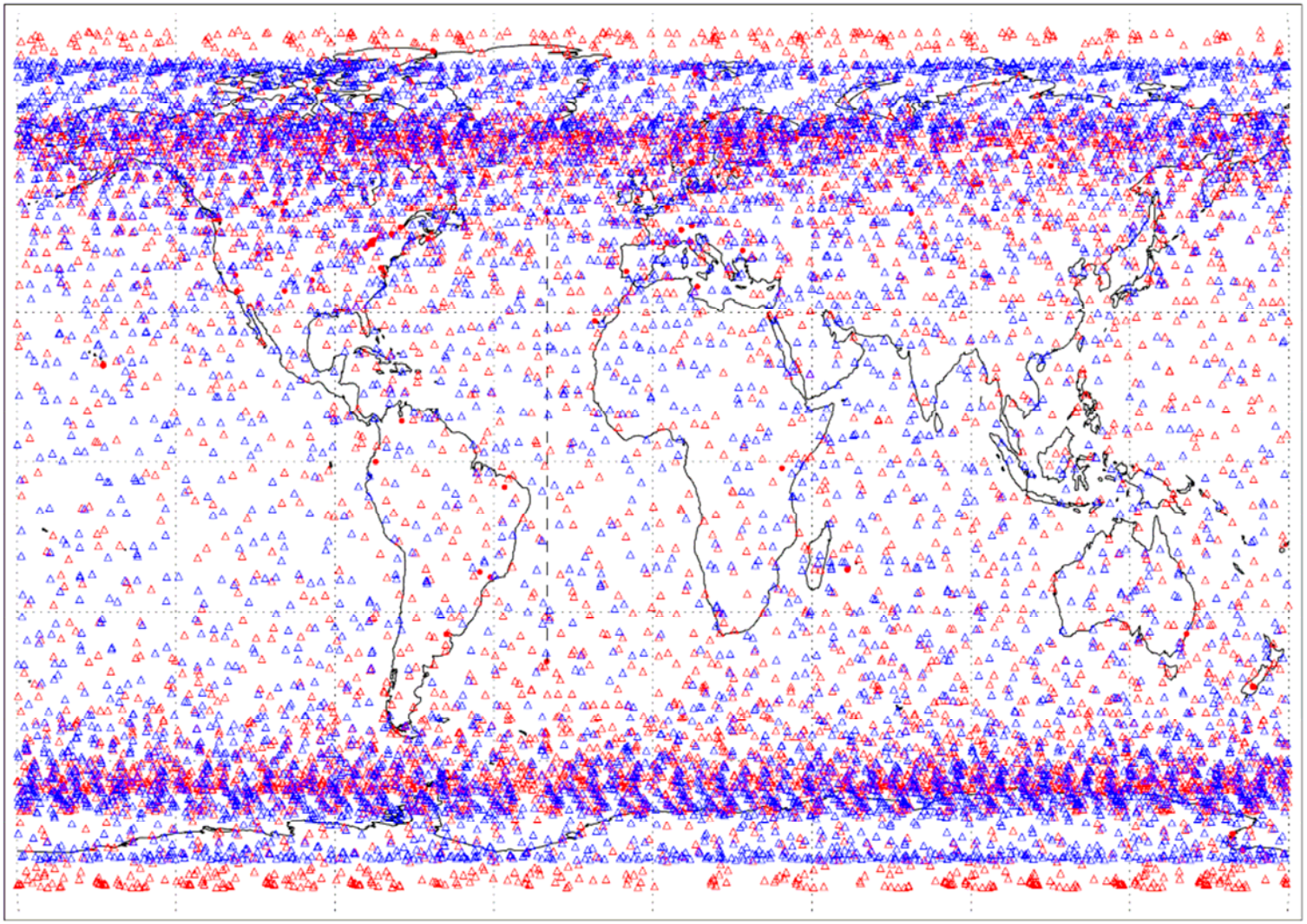
Size:	1.12 m dia. x 1 m
Total mass:	152 kg
Total power:	70 W
(from single solar panel)	
Launch date:	August 12, 2003
Launch vehicle:	Pegasus XL (provided by NASA)
Orbit:	74° inclined circular orbit at 650 km

All ACE measurements to Sept. 10

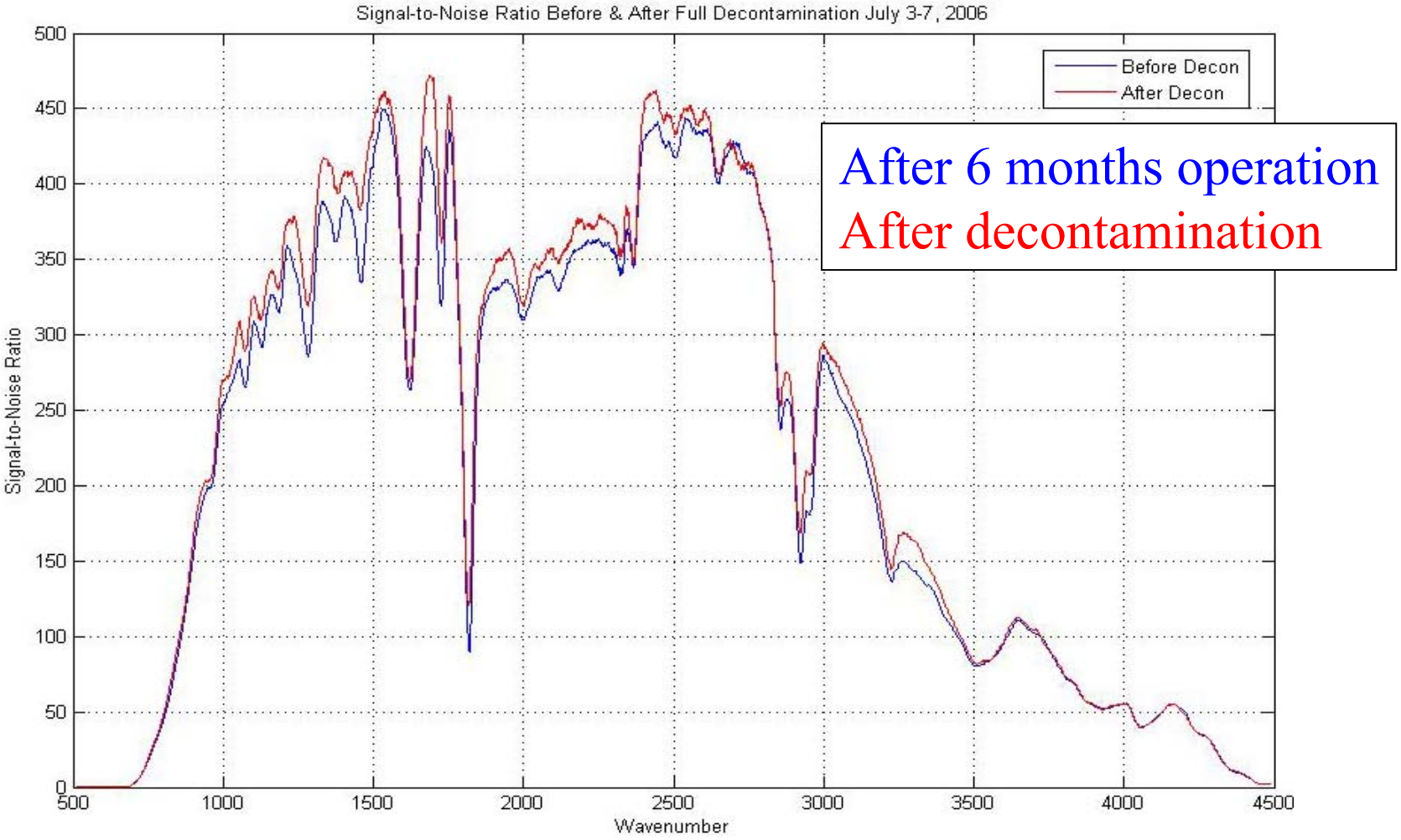


Global Distribution of Occultations

△ SR
△ SS



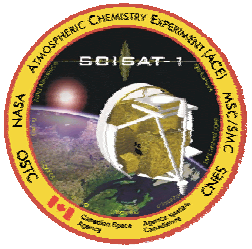
FTS – Decontamination Results



After 6 months operation

After decontamination

Ryan Hughes

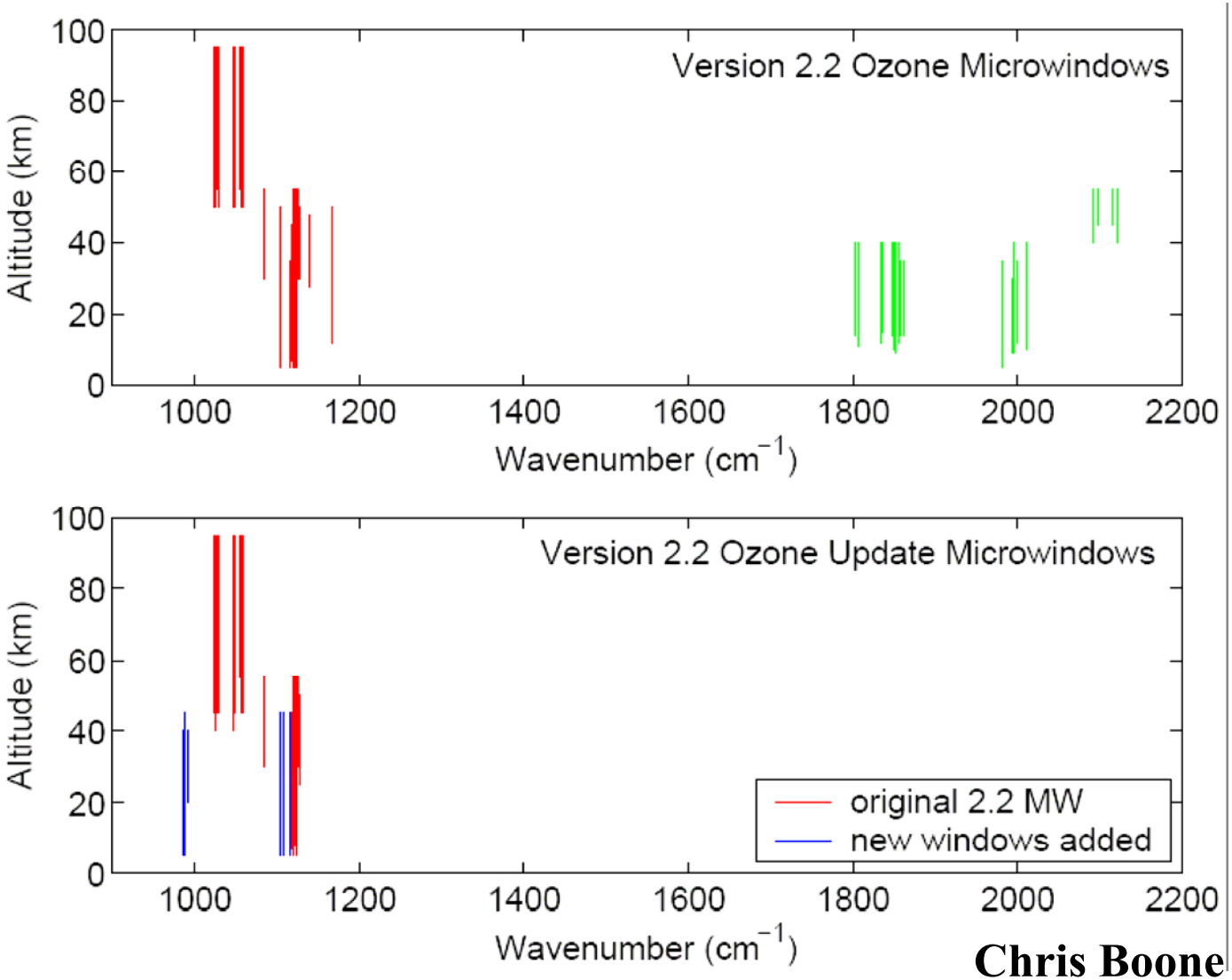


ACE Mission Status

- Satellite and instrument operations are nominal
  - Both instruments have been acquiring as much data as possible ~11,800 occultations recorded since January 2004
- ACE-FTS profiles (version 2.2 + O3 & HDO updates):
  - Baseline: O_3, H_2O, CH_4, N_2O, NO_2, NO, HNO_3, HCl, HF, CO, CFC-11, CFC-12, N_2O_5, $ClONO_2$, temperature and pressure from CO_2 lines
  - Other routine: COF_2, CHF_2Cl, CF_4, CH_3Cl, C_2H_6, SF_6, OCS, HCN
  - Research: CCl_4, HOCl, H_2O_2, HO_2NO_2, CCl_2FCClF_2, CH_3CClF_2, ClO, C_2H_2, N_2 and additional isotopologues
- MAESTRO profiles (version 1.2):
  - O_3 and NO_2 (optical depth)
- IMAGERS profiles (version 2.2):
  - extinction profiles at 0.5 and 1.02 microns

ACE-FTS Ozone Microwindows

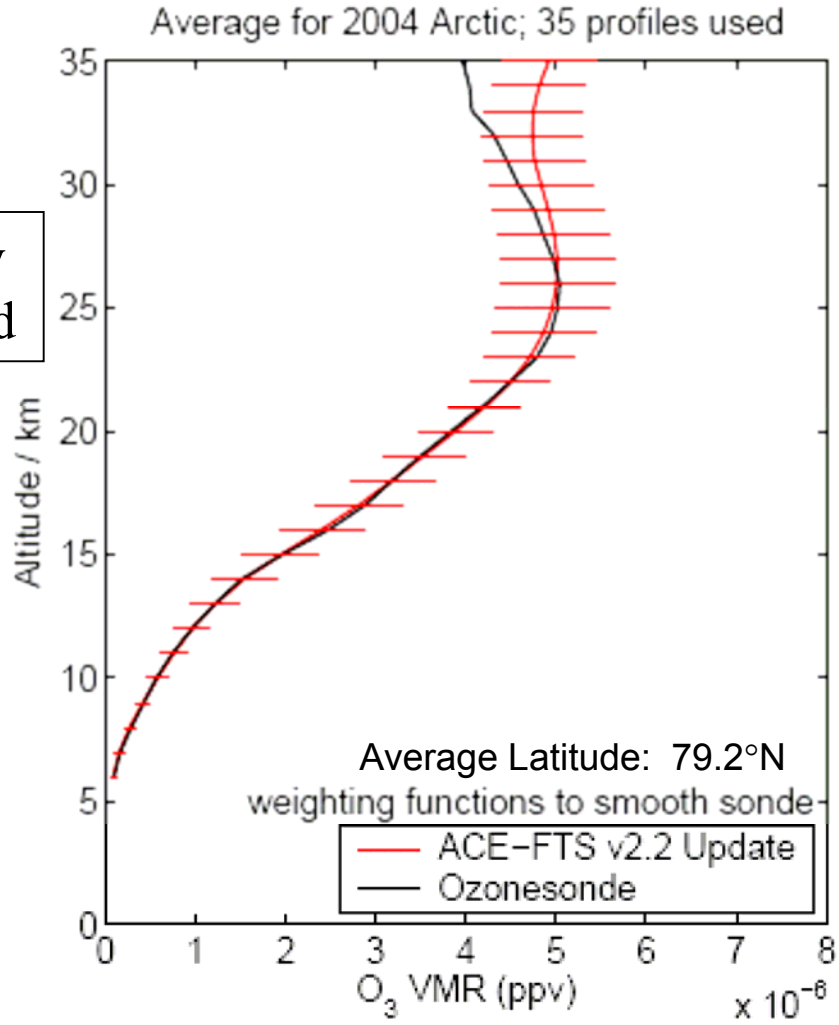
- Inconsistency between two microwindow ranges with HITRAN2004 (10 micron vs. 5 micron)
- New retrieval version is more consistent - uses only ~10 micron band

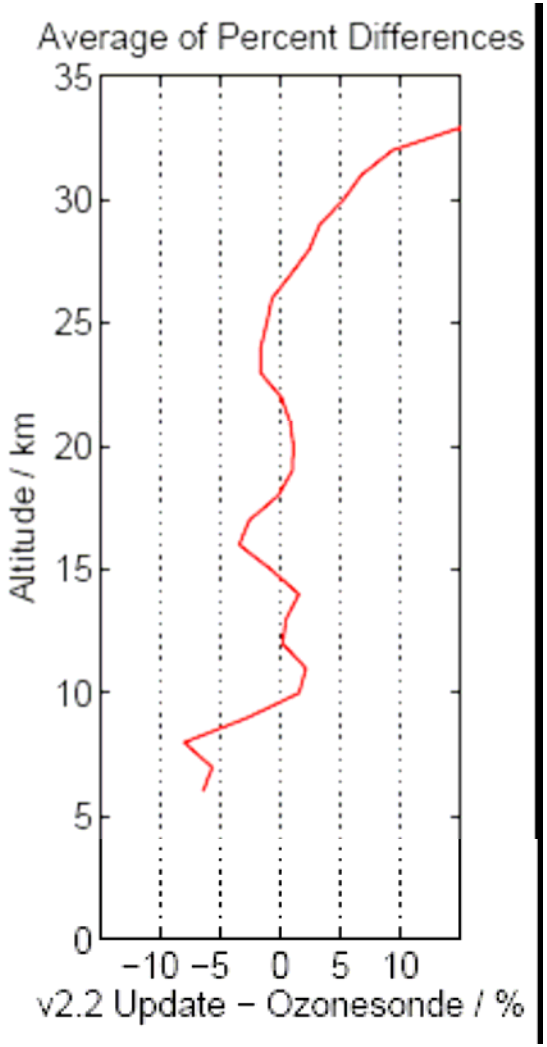


Chris Boone

ACE-FTS Ver2.2 Ozone Update

Using only
10 μm band





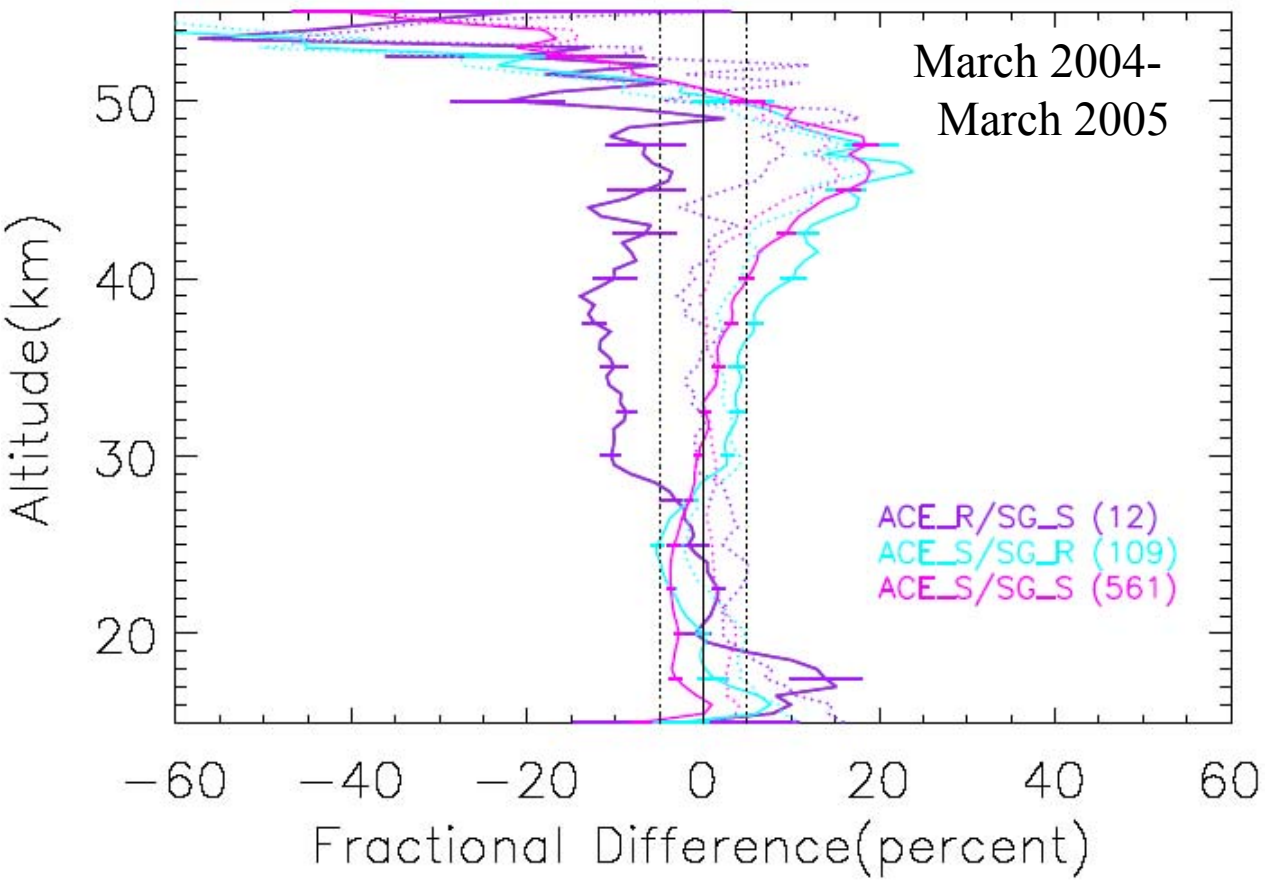
Coincidence criteria: 500 km and 12 hours of sonde launch

Daniel Markel

O_3: MAESTRO, FTS and SAGE III

Above 27 km, MAESTRO O_3 tends to be lower than SAGE III for sunrises and higher for sunsets

Also seen in ozone comparisons with POAM III and ACE-FTS



Solid line: MAESTRO (v1.2) & dotted line: ACE-FTS (v2.2 update)

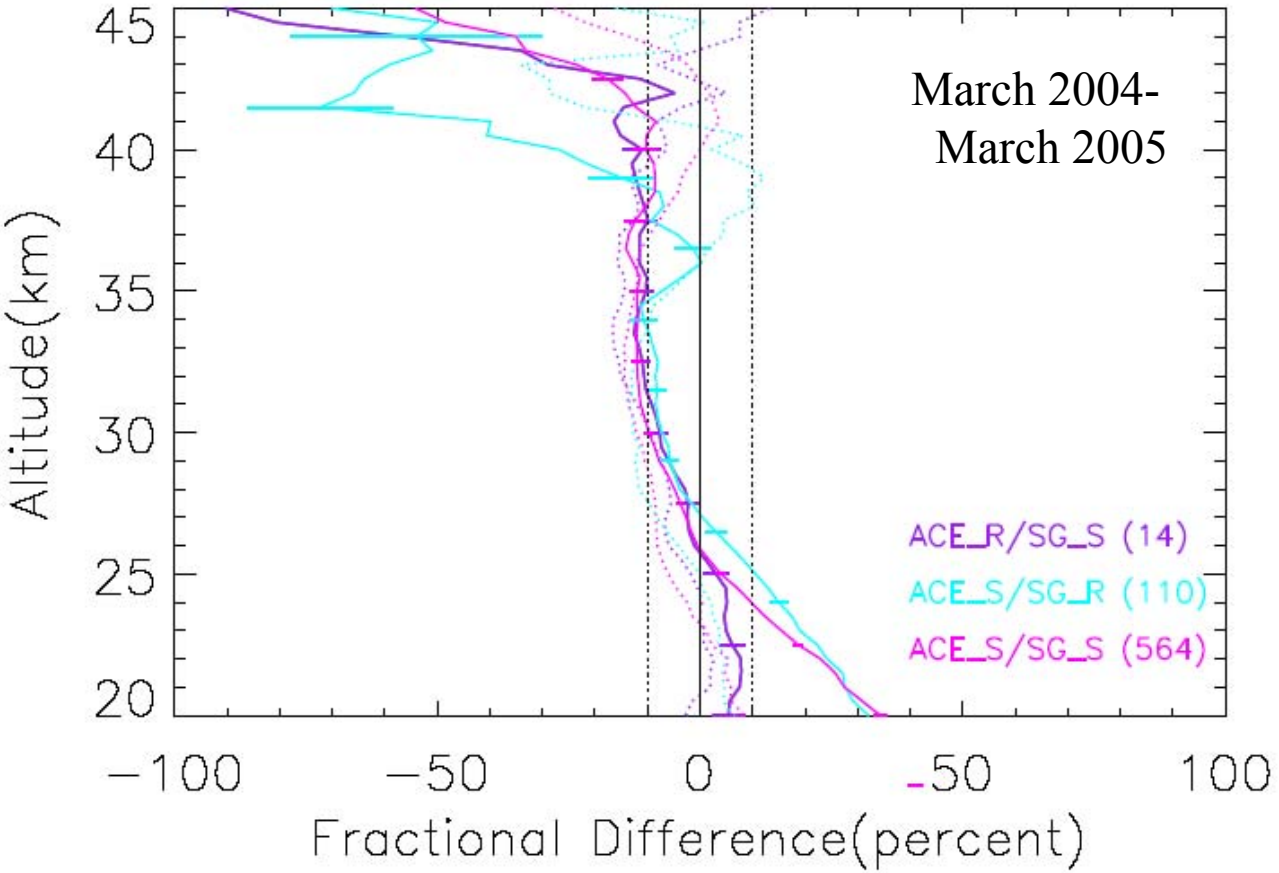
Fractional diff = (ACE-SAGE)/mean

Jay Kar

NO_2: MAESTRO, FTS & SAGE III

NO_2 behavior differs from ozone, both sunrise and sunset profiles lower than SAGE III above 27 km

Suggests that this is not a timing offset - further investigation being done



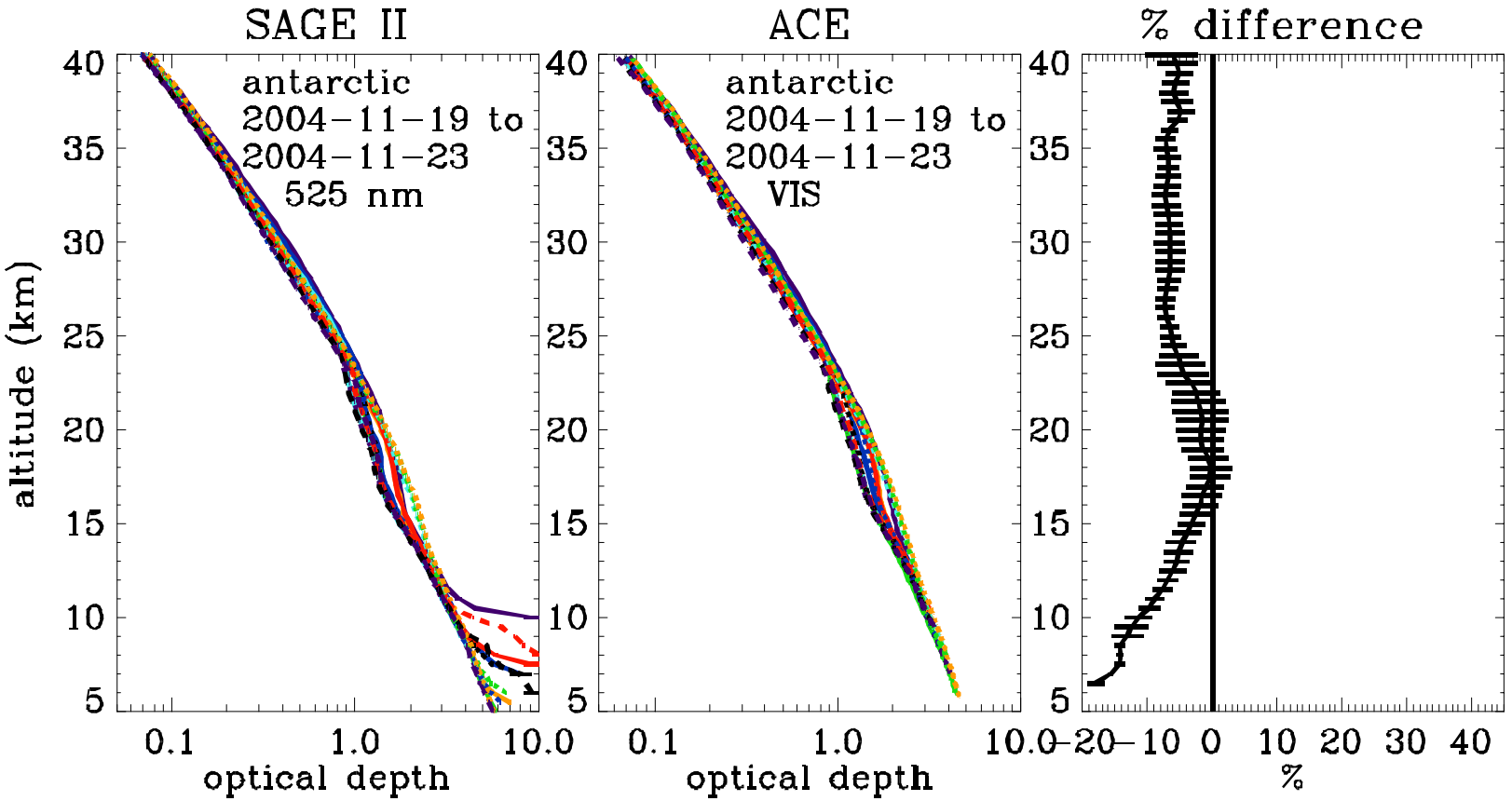
Solid line: MAESTRO (v1.2) & dotted line: ACE-FTS (v2.2 update)

Fractional diff = (ACE-SAGE)/mean

Jay Kar

ACE-IMAGER vs. SAGE II (0.5 µm)

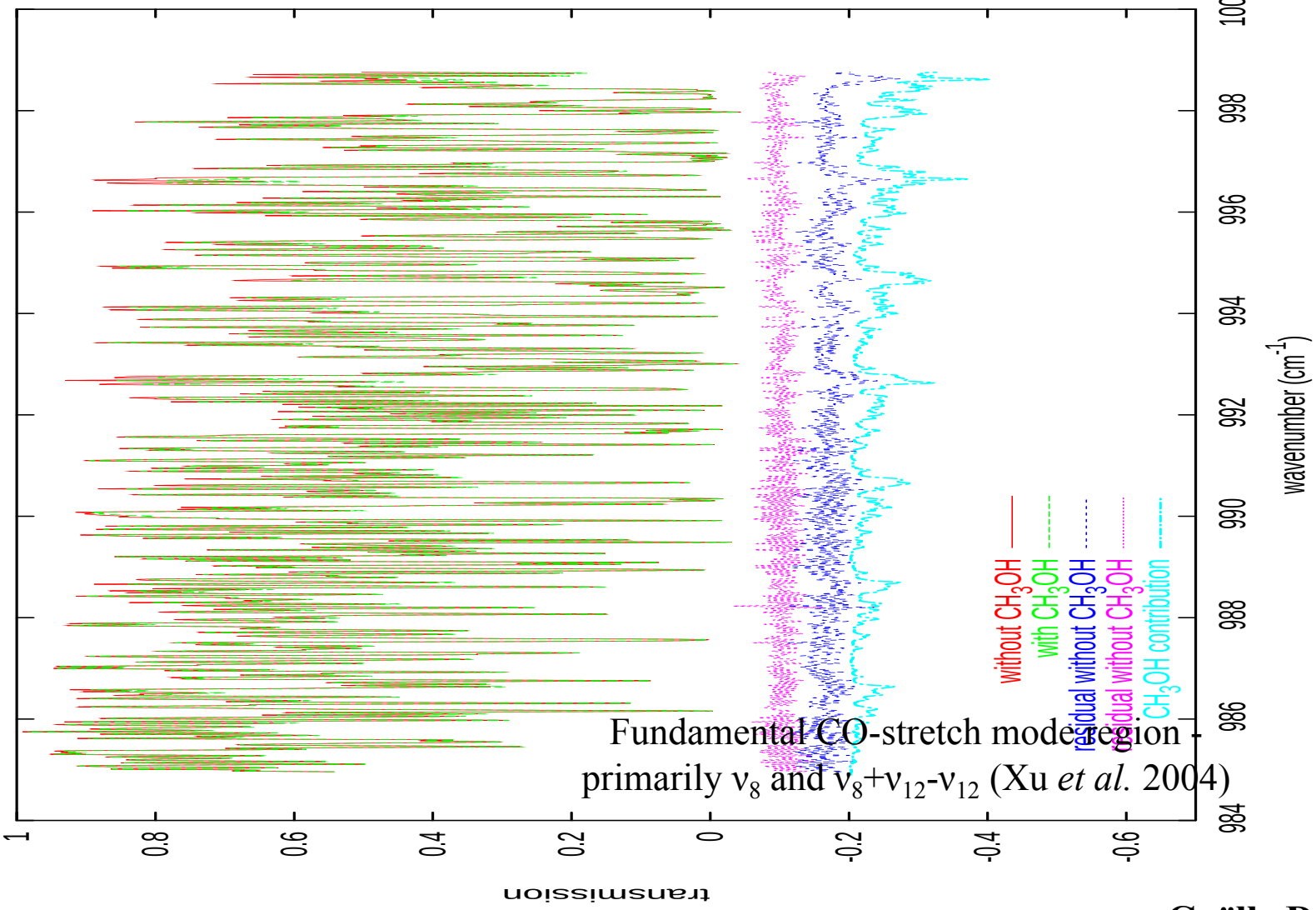
- SAGE II, SAGE III, POAM III and HALOE no longer function: ACE can extend this time series



Coincidence criteria: 200 km and 1 hour (15 profiles)

Kathy Gilbert

CH_3OH contribution to the spectrum



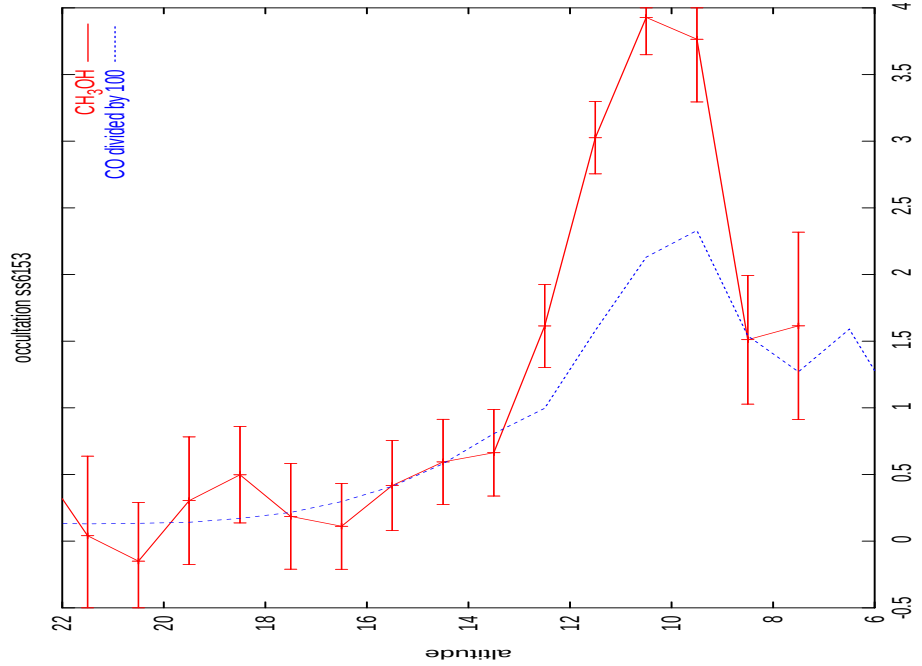
Fundamental CO-stretch mode region - primarily ν_8 and $\nu_8+\nu_{12}-\nu_{12}$ (Xu *et al.* 2004)

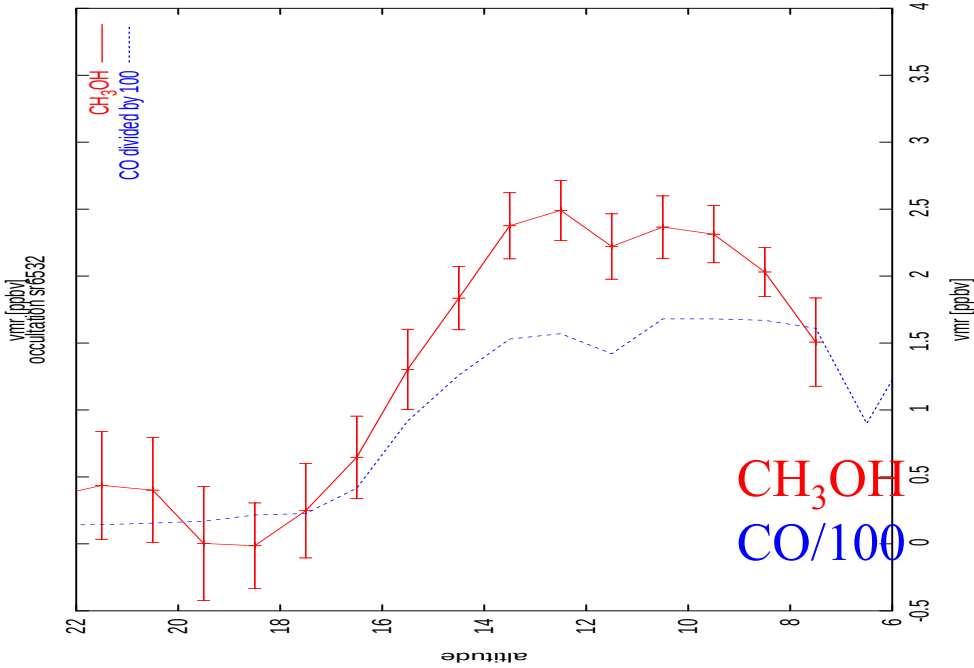
Gaëlle Dufour

Methanol Retrievals

First retrieval of methanol from remote sounding instrument

- Enhanced profiles in biomass burning plumes – SH Oct. 2004
- Similar to results from aircraft measurements in this type of plume

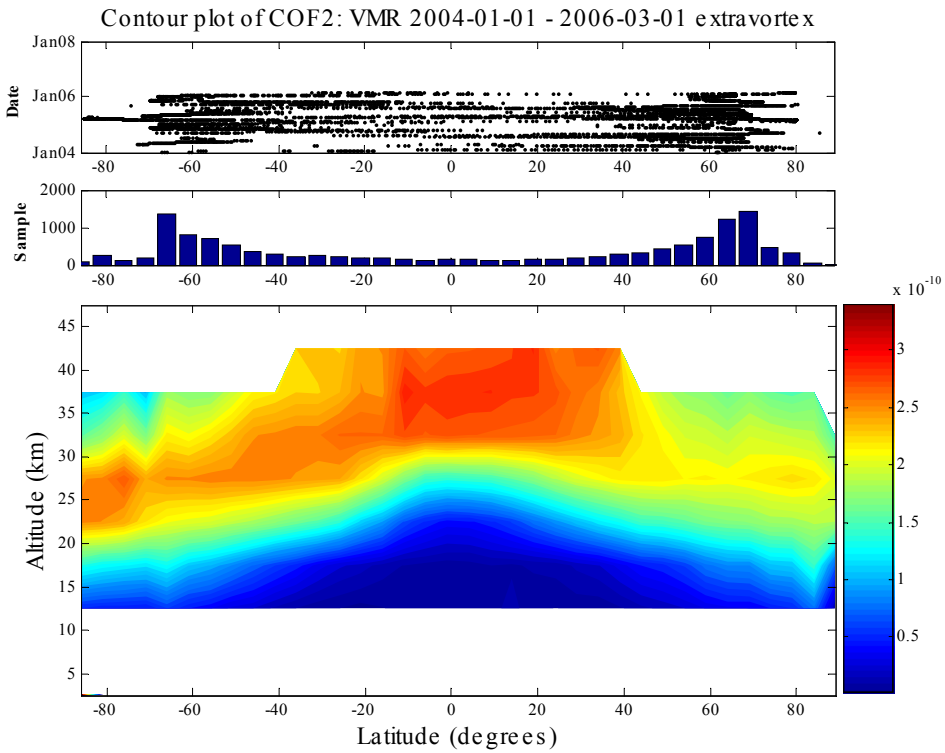




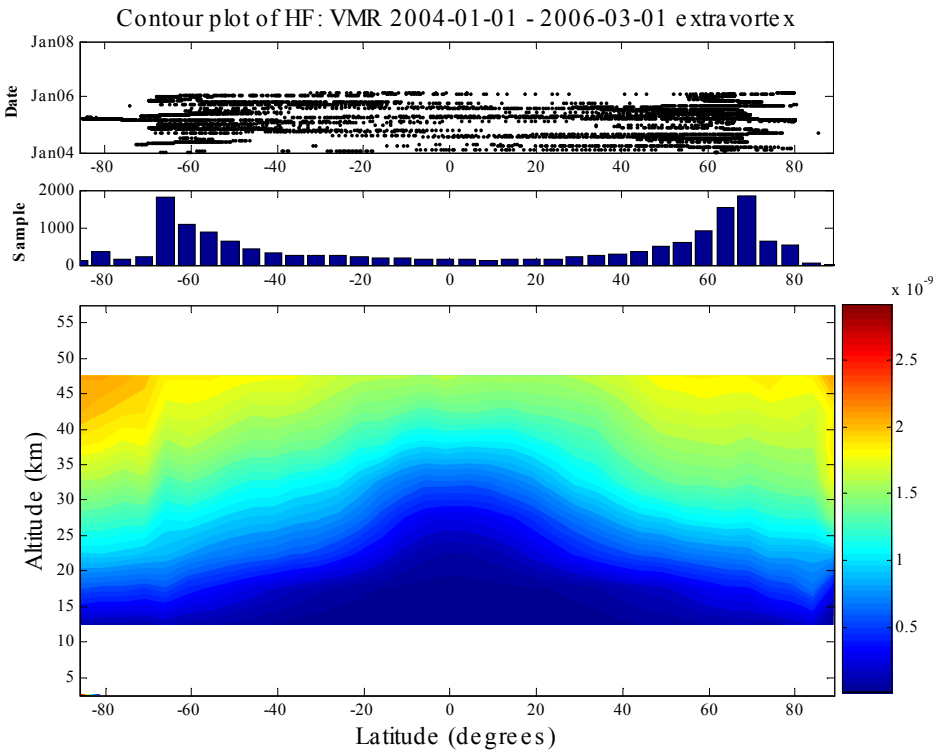
Gaëlle Dufour

Mission Average Zonal Means

COF_2 Measurements

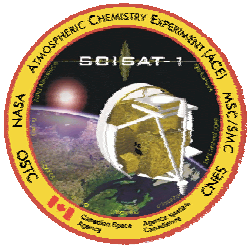


HF Measurements



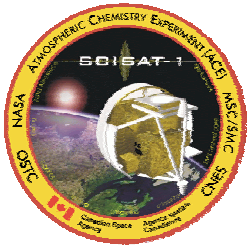
Asymmetry seen in ACE-FTS COF_2 and HF distributions in NH and SH (also seen in model study by Kaye et al. 1991)

Matthew Cooper



Summary

- Validation and Science highlights
  - Improvements have been made in ACE-FTS and ACE-MAESTRO products based on comparisons
    - v2.2 (plus ozone updates) for ACE-FTS and v1.2 for MAESTRO are in the AVDC and are being updated regularly
  - Preliminary comparisons of IMAGER optical depth
  - First measurements of upper tropospheric methanol profiles
    - Contribution to upper tropospheric "air quality" studies measuring CH_4, CH_3OH, HCOOH, HCN, C_2H_2, C_2H_6 plus perhaps PAN and acetone
  - Determination of global distribution of COF_2



Acknowledgement

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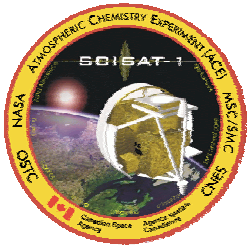
- Canadian Space Agency (CSA)
- Natural Sciences and Engineering Research Council of Canada (NSERC)
- NSERC-Bomem-CSA-MSC Research Chair in Fourier Transform Spectroscopy (at U. Waterloo)



ACE Validation Program

Everything is underway…

- If you have signed up, you should be receiving e-mails about ACE Validation! If not, let me know.

- We would like to involve as many different groups as possible so if you would like to work with us, contact me:

validate@acebox.uwaterloo.ca

- Efforts are organized by subgroups:
  - O_3, H_2O, CH_4, CO, NOy+N2O, Cly/Fy, p/T, aerosols
  - We will put you in contact with the appropriate subgroup

https://databace.uwaterloo.ca/validation/